

ENTERPRISE ARCHITECTURE FOR BUSINESS PROCESS SIMULATION

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ABSTRACT

Many simulation systems are standalone, running only on a desktop and having limited capabilities to integrate with other technologies such as company databases, workflow engines, and other desktop solutions. At the same time, leading corporations have discovered the value of simulation technology. Many companies require simulation to be used as standard procedure in support of process improvements.

A much greater return on investment is possible if process descriptions and simulation results can be accessed throughout the enterprise. A tool that can assist in business process modeling and simulation across an entire organization can enable these gains. This paper addresses the benefits of creating a comprehensive system for the modeling and simulation of business processes on an enterprise-wide basis and presents an architecture for an enabling tool to accomplish these objectives.

1 INTRODUCTION

In order to describe and map business processes, one must have knowledge not only of the static structure of the process, but also of the dynamics of all processes involved. The goal of this research is to provide methodologies and a supporting tool that can be used to capture and analyze processes.

Since the mid- and late 1980's, Business Process Improvement (BPI) and simulation have become leading methodologies to allow corporations to deliver high-quality products and services through business process modeling. Businesses are seeking not simply to automate existing operations, but to improve and redesign business processes to meet and exceed customers' expectations for the delivery of products and services.

By linking interorganizational, interfunctional, and interpersonal levels of the processes through IS networks,

businesses are not only automating their activities, they also are reshaping and improving their business processes (Hammer and Champy, 1993). IS integration provides numerous opportunities to coordinate organizational activities by facilitating communication and information exchange across departments without the need to go up and down the vertical chain of command.

The use of information networks to access relevant information from databases has been of enormous importance in the elimination of duplicate activities, error prevention, and cycle-time reduction in product development and customer responsiveness (Davenport, 1993). An effective database management system is one of the most important requirements for BPI. In most organizations, data architecture has evolved from applications databases in various individual departments, rather than as part of a well-planned overall data management strategy. Therefore, the resolution of data management problems becomes quite difficult (Goodhue, Quillard, and Rockart, 1988).

The access to executable business processes is crucial in business process improvement. Information systems integration, through communication networks and database systems, enables organizations to create and sustain process improvement through timely retrieval of consistent and accurate process information. Process improvement can be measured by the extent to which the desired results are obtained at the outset (e.g., outcomes with zero defect), the extent to which the various processes minimize the consumption of resources, and the extent to which business processes are easily modified to meet or exceed customer expectations.

The proposed system is a set of tools and methodologies that meet customer requests for describing, documenting, modeling, and simulating processes and for measuring process performance. It provides a repository of business processes, models, simulations, and statistical analyses for the activities involved.

2 OBJECTIVES

2.1 Enterprise Repository of Business Processes

Within an enterprise, business process knowledge is a critical asset. Creating and managing this knowledge motivates the organization to address challenges in designing and implementing an information system, including:

- Suitability for many levels and types of access
- Adaptability for strategic, long-term use
- Customizability to support innovation
- Use of legacy information
- Acceptance and compliance by process constituents

The primary objective in building the proposed system is to develop a comprehensive tool that can capture process knowledge in a repository of business processes, thereby providing information to process users. The methodologies and tools provided by the enterprise must support the company's plans in these areas.

2.2 Multiple Users, Varying Needs

Any business, production, service, or other kind of process has a wide array of interested parties, each with different perspectives and needs. In most organizations, many "models"—whether process, data, or descriptive—are used to capture knowledge about the process. Maintaining all of this information and coordinating the dissemination of changes can be costly.

An integrated organization requires a common repository for process knowledge that can be presented and modified using different methodologies and appropriate tools. Process designers need mechanisms for laying out relationships among activities, composing models from subsystem components, and capturing and communicating business rules. Business users require analysis tools for comparing process alternatives, measuring and predicting process costs and performance, and reviewing models for consistency with business objectives. Process performers need a clear, concise tool for understanding their role and its relationship to other activities. Others in the organization may provide process metrics and other data, review process designs, or obtain workflow descriptions.

2.3 Strategic, Long-Term Use

An enterprise process modeling tool must maintain long-term usability as the company changes. However, at any

point in time, an organization cannot anticipate all possible new requirements or the business environment of the future.

To position the process knowledge system for longevity, the core data repository must allow for growth and change in methodologies to be employed based on its contents. Rather than planning to build new monolithic applications more rapidly as replacements for outdated systems (Taylor 1995), an open-architecture approach that supports widely accessible "best-of-breed" tools enables gradual change over time.

2.4 Responsible Innovation

Progressive organizations recognize that supporting responsible innovation fosters an environment of continuous process improvement. Process modeling and simulation can help innovators to measure and understand the value of their ideas.

The methods and tools used to capture process knowledge need to be customizable so that new models, data, and reports can be created "in the field." These models can encourage innovation and support responsible experimentation to drive process improvements without the risk of trying new ideas on the system itself.

2.5 Exploiting Current Information

Except in unusual circumstances, a company deploys process knowledge systems in an environment where there are already existing databases, models, drawings, and other information systems. This legacy information can be valuable, particularly in supplying process metrics and *ad hoc* business rules.

2.6 Usability and Acceptance

The best-designed and architected information system is of little use if it's not used properly and maintained with great integrity. To invite process constituents to use the knowledge system, use of familiar tools (i.e., commercial, off-the-shelf applications) and interfaces that are personalized for various users can ease the change to the new approach.

3 SYSTEM ARCHITECTURE

The repository combines knowledge from several different views in one or more easily accessible databases. Figure 1 shows how the repository combines multiple types of process information.

The repository addresses several objectives. Various process constituents—process designers, owners, and those

involved in its execution—can access shared information. The repository tool can provide security and multi-user features for viewing and modifying process characteristics. And, by storing the process flow and metrics in a methodology-neutral repository, different representations can be presented for a variety of business needs.

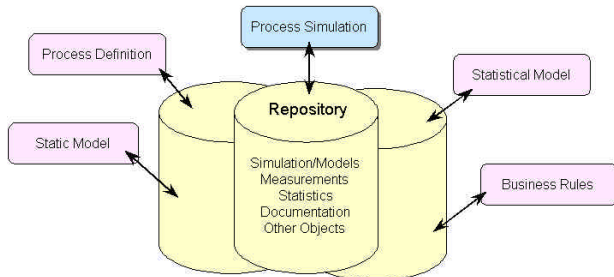


Figure 1: Relationship of Repository to Process Views

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The architecture of the system consists of four layers (Figure 2). The user interface provides a unified layer that hides the modeling, simulation, analysis, and desktop integration layers.

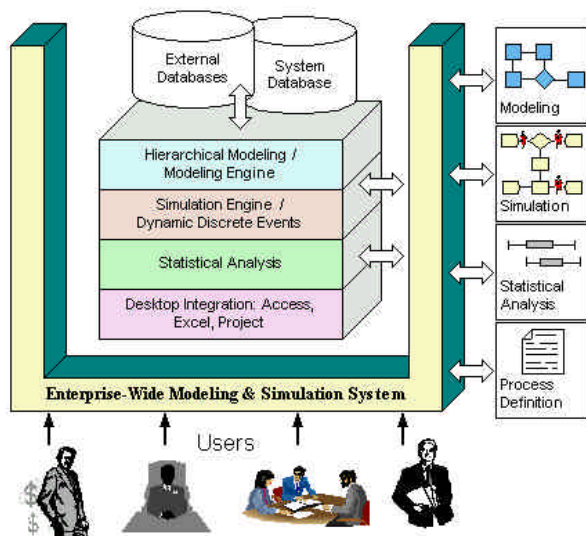


Figure 2: System Architecture

Its design is driven by the enterprise needs described previously. Its feasibility is attributable to technology changes and increasing power of desktop computers.

The process knowledge system is modular to provide insurance against future changes in the organization's structure, business objectives, and operating parameters. Software components are chosen to fulfill requirements for accessibility throughout the enterprise and tailorability to fulfill various constituent needs. Models of enterprise processes are captured and stored in a neutral, shared repository to be utilized as needed by the software tools.

For access throughout the organization, standard, open-architecture client technology reduces the cost and risk associated with deploying the modeling tools. Microsoft® Windows 95/NT® client technology is used with tools that incorporate ActiveX™ and Visual Basic® for Applications (VBA), enabling customization and supporting strategic, long-term use.

The surrounding user interface contributes to all of the enterprise needs. Its appearance and functions can change depending on the user, supporting different needs within the organization. And, as the business environment changes, the knowledge system's interface can be adjusted to reflect the results of innovation and growth. As a tool targeted for use throughout a company, the user interface also can encourage or enforce consistent methodologies and approaches for solving common business problems.

4 SYSTEM CHARACTERISTICS

4.1 Process Modeling

Modeling allows the user to visualize processes. This increases the understanding of relationships and effects among activities and, as a common communications tool for a wide array of individuals, makes the task of validating a process easier.

Because modeling can take place on many levels and models can serve many needs, a flexible, tailorable, widely accessible tool is required. Visio®, a leading desktop drawing product, supplies the common graphics platform for representing business process models. Through its open design based on customizable stencils, Visio readily fulfills the need to present different model representations from a common data repository. Visio's open architecture via ActiveX and VBA enables the overall modeling tool to be customized to fit changing needs. The models also can be shared throughout the enterprise by publishing on an intranet directly from Visio.

4.2 Simulation and Animation

While modeling allows the user to visualize processes, simulation brings them to life. Dynamic simulation allows users to analyze *what-if* scenarios, obtain cost and performance predictions, and validate processes more

easily. The animation of a process enhances the buy-in of process performers, business managers, and others (Profozich, 1998). Simulation also provides a rigor to modeling that can be useful in optimizing business processes. It enables making better decisions, such as how to allocate work to resources, whether to consolidate processes, what shift schedules to operate, and which business rules to employ.

Because of its robust modeling capabilities and state-of-the-art integration capabilities, the Arena[®] Business Edition (BE) is the tool chosen for simulating and analyzing processes. Arena BE includes a built-in interface to Visio, mapping shapes from a Visio drawing to the appropriate simulation constructs in Arena. Process hierarchy is captured in the Arena simulation model, including activity-based costing and process logic, enabling an understanding of the distribution of cost and effort among process components. As with Visio, Arena supplies robust ActiveX support, a Microsoft[®] Office 97-compatible interface, and VBA to fulfill enterprise needs for best-of-breed software products.

4.3 Decision Support

The tool provides a collection of reference information to support key decisions. This is done by establishing a query and search function on existing processes and by generating various forms of reports that are accessible throughout the organization.

As with the models themselves, it is critical that the information supplied by the tool for supporting business decisions be appropriate for each of the user needs. Tools such as Microsoft[®] Access[®] and Microsoft[®] Repository supply built-in capabilities for customizing reports and for publishing them in a variety of commonly used formats.

4.4 Use in the Enterprise

The proposed system provides a mechanism and environment for collecting process metrics; recording problems such as bottlenecks, inaccurate information, etc.; and providing solutions for each step of the process. In the pilot project, we are planning to allow employees to access their processes and provide the system with metrics.

The tool provides a reusable and repeatable way to capture processes. Furthermore, it provides a reusable and repeatable means for modeling, simulation, and performance measurement. By using market-leading, commercial software, minimal training in the tool is required, contributing to rapid, cost-effective deployment.

Significant benefits can be realized by using the proposed system via a corporate intranet. The intranet server can become a repository of executable models that

can be used across the firm. This can assist in standardization of processes. For example, a model constructed for a specific department can be reused when designing new one. Furthermore, what-if scenarios can be explored across the intranet, without the need for remote users to install the entire toolset.

A history of modeling process metrics, results of experiments, etc., can be maintained for analysts, users, and managers. With a corporate history of process improvement, knowledge gained through modeling and simulation can contribute to managing future change.

5 CONCLUSIONS

The proposed system is a set of tools and methodologies that can be used to meet customer needs for describing, documenting, modeling, and simulating processes and measuring their performance at the enterprise level. It provides a repository of business processes, models, simulations, and statistical analyses for the activities involved. This tool is designed as a technology foundation to integrate business process simulation successfully into a repository for enterprise-wide accessibility of simulation.

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Simulation Management System (MS)² and is responsible for deploying the tool throughout the BCAG. Soheila received her B.S. from Wesleyan University in Business Administration, conducted her advanced studies at the University of Missouri-Rolla, and currently is working on her Ph.D. at Seattle University.

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